June 19, 1956 J. A. CANTER 2,750,756

REFRIGERATING APPARATUS FOR WATER COOLERS

Filed Oct. 21, 1952 4 Sheets-Sheet 1

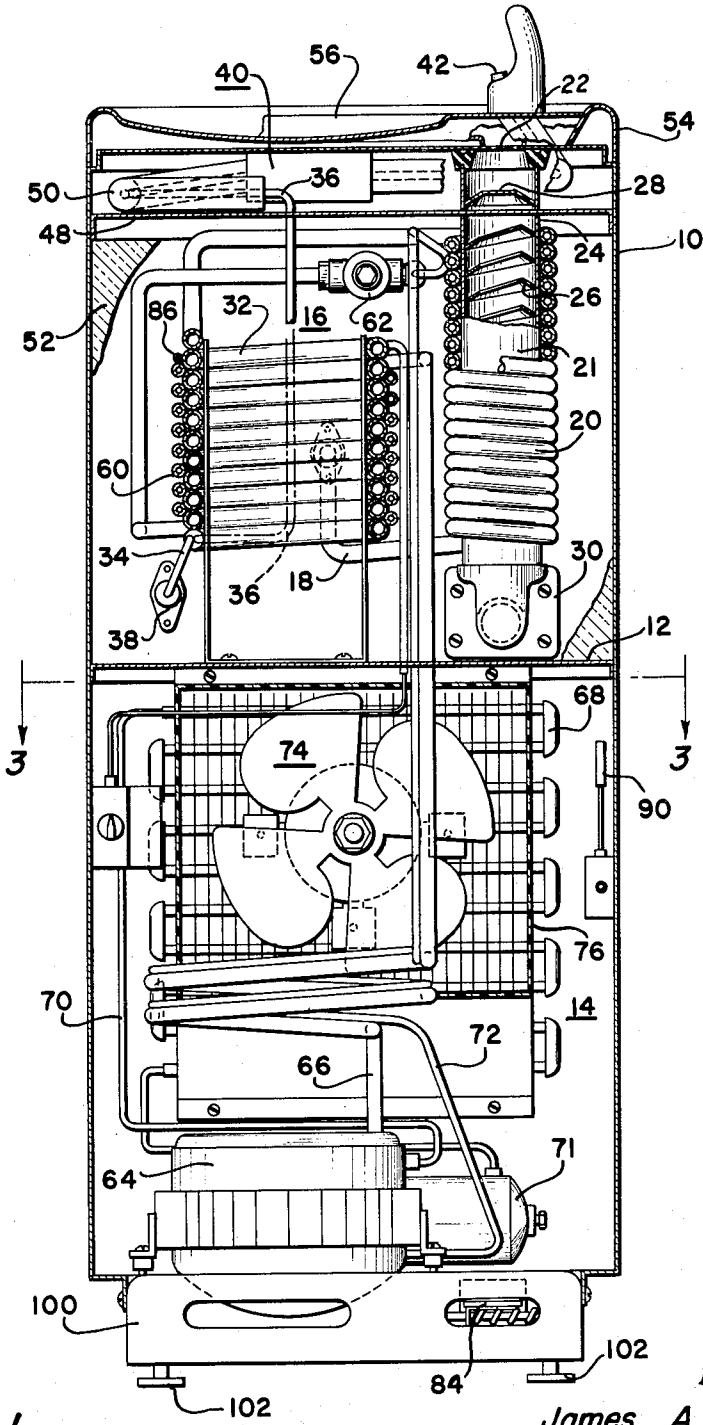


Fig. 1

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Filed Oct. 21, 1952 4 Sheets-Sheet 2

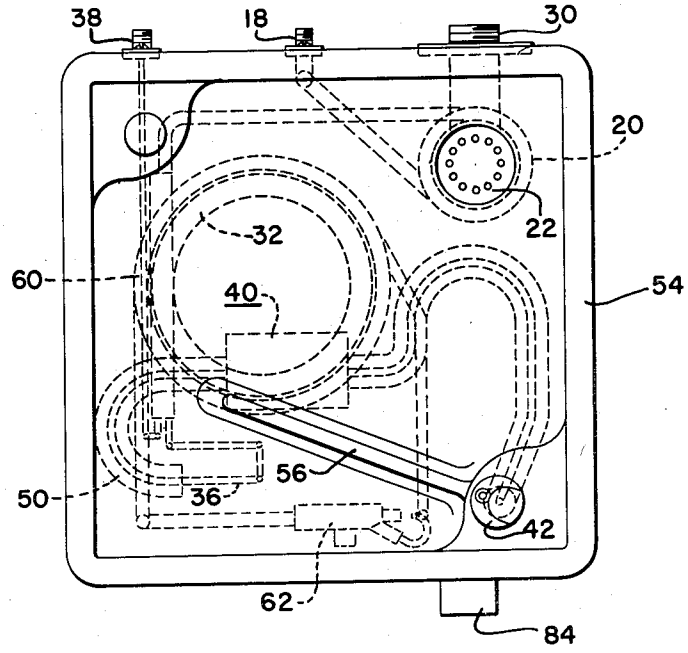


Fig. 2

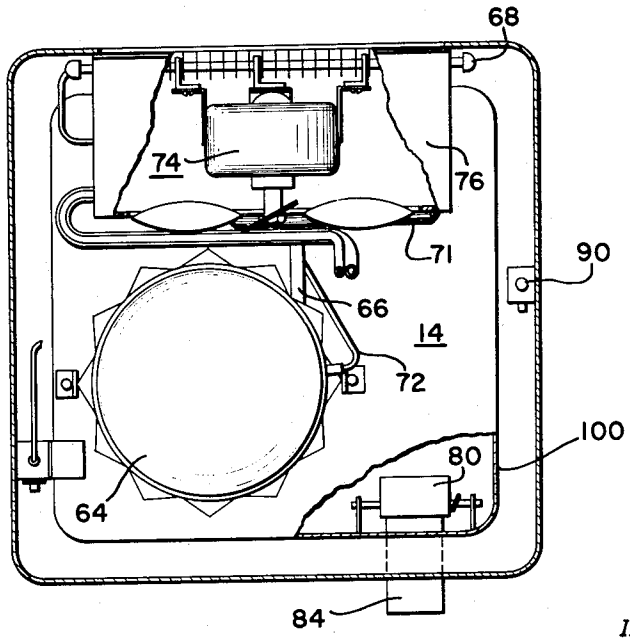


Fig. 3

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REFRIGERATING APPARATUS FOR WATER COOLERS

Filed Oct. 21, 1952 4 Sheets-Sheet 3

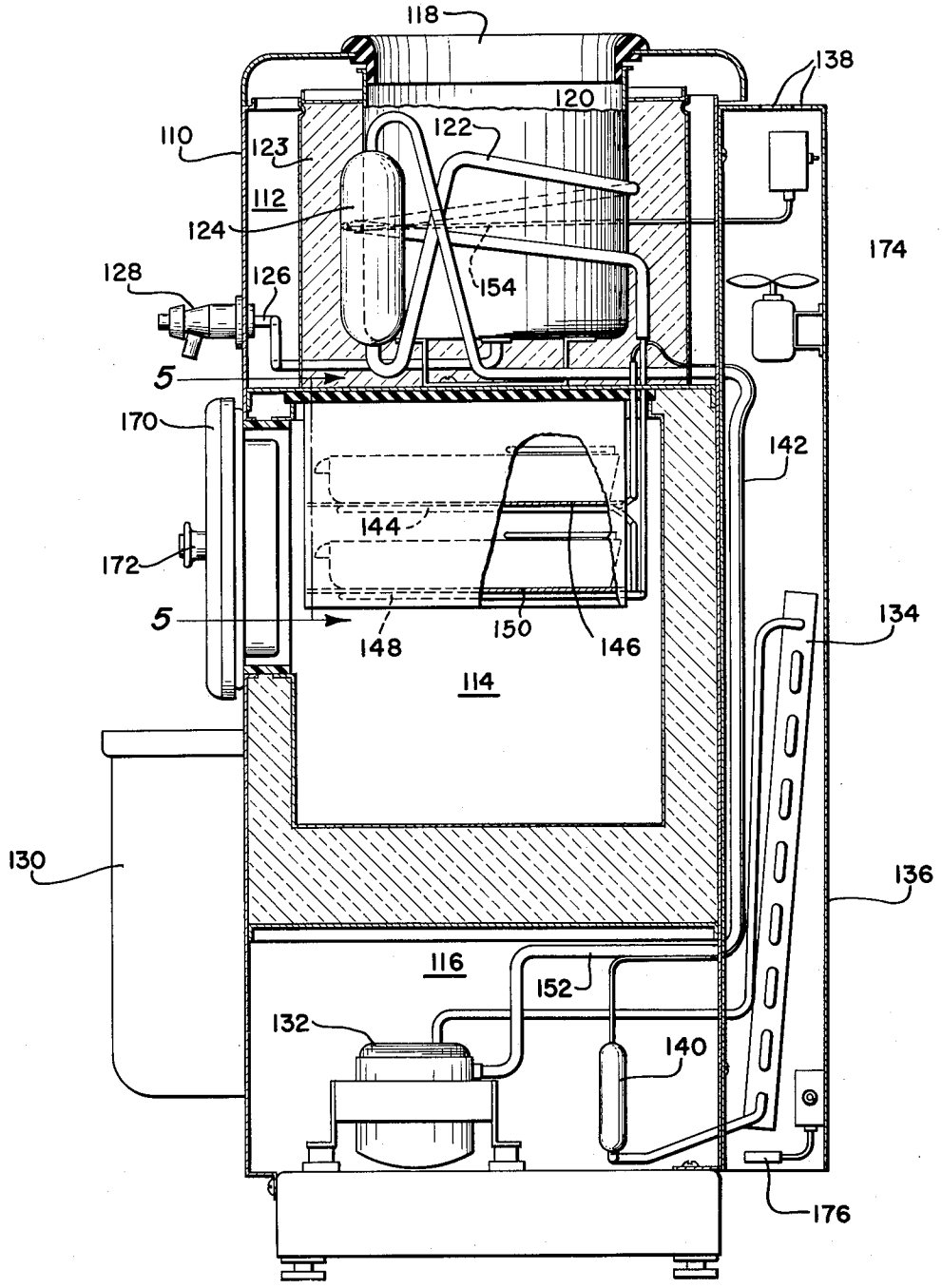


Fig. 4

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REFRIGERATING APPARATUS FOR WATER COOLERS

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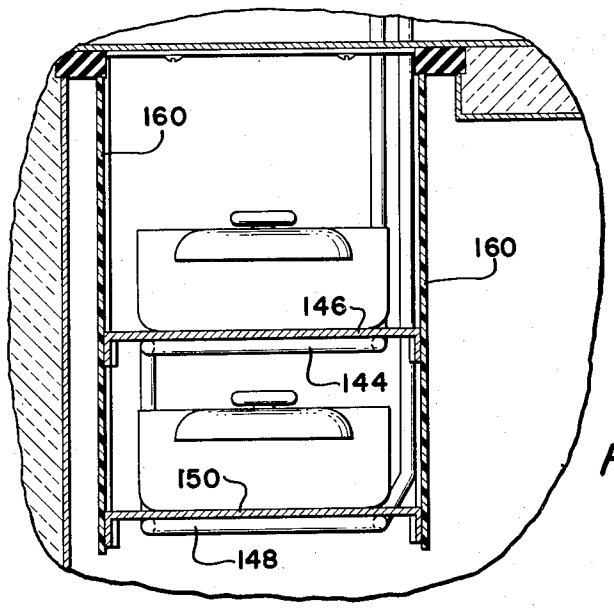


Fig. 5

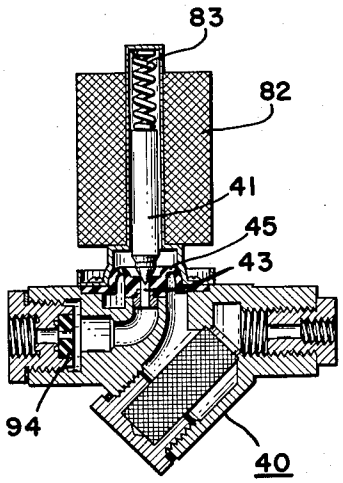


Fig. 6

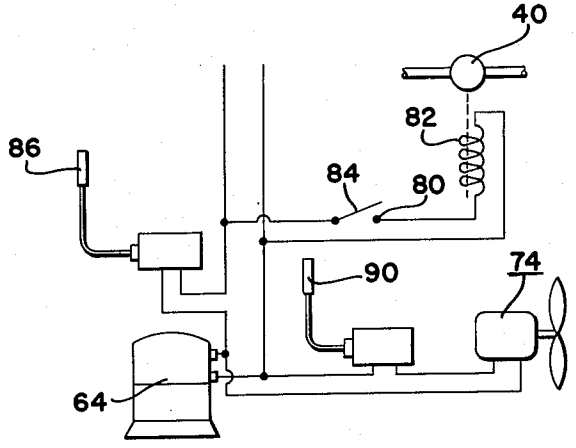


Fig. 7

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2,750,756

REFRIGERATING APPARATUS FOR WATER COOLERS

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Application October 21, 1952, Serial No. 316,018

5 Claims. (Cl. 62—4)

This invention relates to refrigerating apparatus and more particularly to water coolers.

It is an object of this invention to provide an efficient water cooler which may be manufactured at a low cost without sacrificing quality or desirable functional features.

Another object of this invention is to provide a water cooler having an improved type of temperature control. More particularly it is an object of this invention to provide control means for preventing the water coils from freezing when the ambient temperature is low even though the main water temperature responsive control switch may fail to function.

Still another object of this invention is to provide a water cooler having means for freezing ice cubes and storing foods or bottled beverages at a low temperature.

A further object of this invention is to provide an improved arrangement of structural elements in a water cooler.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Figure 1 is a vertical sectional view of a preferred embodiment of the invention;

Figure 2 is a plan view of the structure shown in Figure 1;

Figure 3 is a sectional view with parts broken away taken substantially on the line 3—3 of Figure 1;

Figure 4 is a vertical sectional view of a bottle type cooler having a refrigerated storage space incorporated therein;

Figure 5 is a fragmentary sectional view taken substantially on the line 5—5 of Figure 4;

Figure 6 is a sectional view through the control valve; and

Figure 7 is a schematic view showing the main electrical controls.

Referring now to Figure 1 of the drawing, reference numeral 10 designates a main casing which serves to enclose the refrigerating apparatus. A horizontal partition 12, located approximately in the central portion of the casing 10, separates the casing into a lower refrigerant liquefying compartment 14 and an upper evaporator or water-cooling compartment 16. The water to be cooled enters the unit through the pipe 18 and first enters a precooling coil 20 which forms a part of a heat interchanger generally designated by the reference numeral 21 and then enters the large cooling coil 32 from whence the cooled water flows to the bubbler 42 in a manner to be described hereinafter more fully.

The heat interchanger 21 causes the incoming water to be cooled by the wasted cold water flowing into the drain 22. The waste water which enters the drain 22 is caused to flow in thermal exchange relationship with the walls of a long narrow cylindrical element 24 which

is provided with an internal spirally arranged baffle 26 which causes the water to flow in direct contact with the wall of the cylinder 24 so as to absorb heat from the water flowing through the coil 20. It is obvious that the spiral arrangement of the baffle 26 causes the outgoing water to remain in thermal exchange relationship with the incoming water for an appreciable length of time before finally reaching the drain 30. A baffle 28 is provided in the upper end of the cylinder 24 and serves to direct the water entering cylinder 24 out towards the wall thereof so as to be picked up by the spiral baffle 26.

After the water leaves the coil 20 it flows into the upper end of the main cooling coil 32. The lower end of the cooling coil 32 connects to a pair of water lines 34 and 36 as best shown in Figures 1 and 2. The line 34 leads to a fitting 38 to which a faucet or remotely located bubbler may be connected. The line 36 is a main water line and this leads to a solenoid operated water control valve generally designated by the reference numeral 40 which controls the flow of refrigerated water to bubbler 42. Insulation 52 surrounds the water coils and lines in the compartment 16 and that portion of the water line 36 which extends above the upper partition 48 is wrapped in insulation 50 which prevents sweating of the pipe 36 and retards the admission of heat into the cold water after leaving the insulated compartment 16.

The water cooler top 54 is preferably made from porcelain coated sheet metal and is provided with a water splitting projection or dam 56 directly in line with the jet of water leaving the bubbler 42 so as to prevent splashing of the water which hits the top of the cooler.

The water flowing through the large water-cooling coil 32 is refrigerated by means of a refrigerant evaporator coil 60 which surrounds the coil 32 as best shown in Figure 1. Liquid refrigerant enters the lower portion of the evaporator coil 16 with the result that the incoming water and the liquid refrigerant flow in countercurrent relationship to one another. The flow of refrigerant to the evaporator coil 60 is controlled by a conventional automatic expansion valve 62.

The refrigerant liquefying apparatus which supplies liquid refrigerant to the evaporator 60 consists of a conventional sealed motor-compressor unit 64 which withdraws vaporized refrigerant from the evaporator 60 through the suction line 66. The compressed refrigerant leaving the motor-compressor unit 64 flows into a condenser 68 through the line 70. The condensed or liquid refrigerant flows from the condenser 68 into a receiver 71. The liquid refrigerant leaves the receiver 71 through a liquid line 72 which is arranged in thermal exchange relationship with the suction line 66 throughout a major portion of the length of the suction line 66. A fan 74 serves to provide for circulation of air over the condenser 68. A shroud 76 is provided as shown and serves to direct the air over the condenser. This shroud is made of asphalt impregnated fiberboard which serves to deaden the noises produced within the machinery compartment 14.

The controls for the apparatus described hereinabove are best shown in Figure 7 of the drawing. Thus, the water valve 40 is controlled by a foot operated switch 80 which serves to energize the water valve operating solenoid 82 whenever the foot pedal 84 is depressed. The motor-compressor unit is controlled by means of a thermostat 86 which is arranged in thermal exchange relationship with both the first convolution of the water-cooling coil 32 and the last convolution of the evaporator 60. By virtue of this particular arrangement the compressor will be caused to operate very promptly as warm water begins entering the coil 32 and will stop operating when the resultant temperature of the water and the refrigerant indicates that no more refrigeration is required.

The thermostat 86 will normally function so as to pre-

vent operation of the motor-compressor unit long enough to cause freeze-up in the water coil 32. However it is well recognized that thermostatically operated switches will eventually become somewhat erratic in operation due to pitting of the contacts and other causes. Under most operating conditions prolonged operation of the compressor to the point where the water would begin to freeze would be prevented by the automatic expansion valve 62 shutting off the flow of refrigerant to the evaporator 60. However, it is recognized that there are times when water coolers will be used in cold surroundings with the result that such a large quantity of refrigerant will be in the liquid phase in the condenser that the pressures in the evaporator and the condenser will be such as to cause water freezing temperatures. In order to prevent freezeup under the above described conditions there is provided a thermostat 90 which interrupts the flow of current to the condenser cooling fan 74 at low ambient temperatures so as to thereby effectually reduce the condenser capacity at low ambient temperatures. This reduction in the condenser capacity is instrumental in maintaining the necessary pressure within the system to cause proper functioning of the expansion valve 62 even at a low ambient air temperature, with the result that the supply of liquid refrigerant to the evaporator will be adequate to maintain proper pressures and resultant temperatures in the evaporator to prevent water freezing temperatures to occur even though the thermostat would fail for any reason. In order to simplify this disclosure the usual motor protective devices such as the high pressure cutout control and the current overload control have not been shown.

The valve 40, which controls the flow of water to the bubbler 42, includes a spring pressed plunger 41 which serves to seal the aperture 43 in the center of the diaphragm 45 whenever the solenoid 32 is deenergized. Energization of the solenoid 32 causes the plunger 41 to compress the spring 33 and to open the orifice 43. The valve 40 also has incorporated therein a pressure regulating orifice 94 which serves to automatically restrict the flow of water at higher water pressures. The pressure regulating orifice 94 comprises a rubber-like washer arranged in the path of the water. The aperture through the washer and the thickness of the washer are such that at low water pressures the correct amount of water will flow through the orifice without distorting the washer. However, as the incoming water pressure increases, the flow regulating washer will become distorted in a manner to reduce the size of the orifice and thereby restrict the quantity of water flowing.

As best shown in Figure 1 of the drawing, the casing 10 sets on a perforated platform 100 which is slightly smaller than the casing 10 so as to provide an inwardly extending offset adjacent the bottom of the water cooler. Adjustable floor engaging feet 102 are provided at the four corners of the base 100 so as to make it possible to compensate for any unevenness in the floor on which the water cooler rests.

In Figures 4 and 5 of the drawing there is shown a bottle type water cooler embodying features of the invention. The water cooler shown therein comprises a main cabinet 110 which includes a water-cooling compartment 112, a food and beverage storage compartment 114 and a machinery compartment 116. A resilient gasket 118 is provided in the top wall of the cabinet for supporting an inverted water bottle (not shown) which discharges water into the insulated and refrigerated water-cooling chamber 120 located in the compartment 112. An evaporator coil 122 is arranged in thermal exchange relationship with the outer wall of the water chamber 120 and this in turn is surrounded by insulation 123. The refrigerated water leaves the bottom of the compartment 120 through a line 126 which leads to a faucet 128 located above the conventional drain receptacle 130. The drain receptacle 130 is of conventional construction and is removably supported on the front wall of the cabinet 110 in accordance with standard practice. A motor-compressor unit 132 is located in the machinery compartment 116 and serves to discharge the compressed refrigerant into a condenser 134 located in a flue 136 provided adjacent the rear of the cabinet 110. The bottom of the flue 136 is completely open as shown in Figure 4 and the top is provided with apertures 138 through which the heated air freely flows.

A receiver 140 is provided at the outlet of the condenser 134. A capillary tube type of restrictor 142 conveys liquid refrigerant from the receiver 140 to a pair of evaporator coils 144 and 148 attached to metal shelves 146 and 150 respectively located in the compartment 114. The excess refrigerant leaving the shelf 150 flows upwardly to the evaporator coil 122 which surrounds the water sealed chamber 120. The outlet of the evaporator 122 leads into an accumulator 124 which is arranged as shown. The outlet of the accumulator 124 is connected to the suction line 152 of the compressor 132. The motor-compressor unit 132 is adapted to be started and stopped by means of a thermostat 154 which is arranged in thermal exchange relationship with the outer surface of the mid-portion of the evaporator coil 122.

It frequently happens that water coolers of this type are used in offices and the like where no other type of refrigeration is available. By incorporating a refrigerated compartment, such as the compartment 114 in the water cooler housing it is possible to not only freeze ice cubes but also refrigerate such items as bottled beverages, fruits, medicines and the like. One of the problems in refrigerating such a compartment is that of obtaining low enough temperatures to freeze ice cubes without producing temperatures low enough to freeze fruit or bottled beverages stored in the lower portion of the compartment. It has been found that by passing the incoming liquid refrigerant in direct thermal exchange with the ice tray supporting shelves and maintaining the area of the shelves and other heat radiating surfaces connected thereto at a minimum, it is possible to maintain the proper temperatures within the compartment 114.

The shelves 146 and 150 are supported between a pair of plastic plates 160 which have a relatively low coefficient of heat transfer so as to prevent excessive refrigeration in the compartment 114. A door 170 is provided at the entrance to the compartment 114. A tumbler type of lock 172 is provided so as to enable one to lock the compartment 114 if desired.

The water cooler shown in Figure 4 is provided with an air cooled condenser located in the flue 136 adjacent the rear of the cabinet. For purposes of ilustration, we have shown a flue in which an air circulating fan 174 has been provided in the upper part of the flue whereas it is obvious that this fan could be eliminated. This fan would be controlled in response to a thermostat 174 located in the flue 136. In those installations where the ambient air temperature never falls below 60° F. the use of a thermostat to control the fan 174 would not be necessary and as explained hereinabove in some cases it is possible to make the condenser large enough and to obtain enough natural air circulation over the same to provide the necessary refrigeration for the bottle type water cooler without the use of forced circulation. The fan 174 would otherwise serve the same purpose and would be controlled in the same manner as the fan 74 shown in the pressure type water cooler described hereinabove.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a refrigerating system for a water cooler, an evaporator, a water conduit in direct thermal exchange relationship with said evaporator, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, fan means for flowing

air in thermal exchange relationship with said condenser, and safety means for preventing pressures in said system low enough to cause freezing of the water, said safety means including thermostatic means for stopping said fan means in response to a reduction in the ambient air temperatures below approximately 60° F.

2. In a refrigerating system for a water cooler, an evaporator for cooling water, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, a water cooling conduit in thermal exchange with said evaporator, and a thermostat arranged in thermal exchange relationship to the inlet of said conduit and the outlet of said evaporator for controlling the operation of said compressor, fan means for flowing air in thermal exchange relationship with said condenser, and safety means for preventing excessively low water temperatures, said safety means including thermostatic means for stopping said fan means in response to a reduction in the ambient air temperatures below approximately 60° F.

3. In a refrigerating system for a water cooler, an evaporator for cooling water, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, a water cooling conduit in thermal exchange with said evaporator, and a thermostat arranged in thermal exchange relationship to the inlet of said conduit and the outlet of said evaporator for controlling the operation of said compressor, fan means for flowing air in thermal exchange relationship with said condenser, and safety means for preventing pressures in said system low enough to cause freezing of the water, said safety means including thermostatic means for stopping said fan means in response to a predetermined reduction in the ambient air temperatures, a solenoid valve for controlling the flow of water through said conduit, and a foot operated switch for controlling the energization of said solenoid valve.

4. In a water cooler, an evaporator, a water cooling element in thermal exchange with said evaporator, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, a bubbler connected to the outlet of said water cooling element,

a drain for the excess water, means for flowing the incoming water to be cooled in thermal exchange with the water flowing through said drain and a thermostat influenced jointly by the temperature of the water entering said cooling element and the refrigerant leaving said evaporator for controlling the flow of refrigerant through said compressor, condenser and evaporator, a solenoid valve for controlling the flow of water to said water cooling element, a foot operated switch controlling the operation of said solenoid valve, and means for regulating the pressure of the cooled water flowing to said bubbler, said last named means comprising a resilient washer having an orifice therein, the thickness of said diaphragm and the normal diameter of said orifice being correlated so as to cause distortion of said diaphragm at higher water pressures.

5. In a refrigerating system for a water cooler, an evaporator for cooling water, a condenser, a compressor, refrigerant flow connections between said evaporator, condenser and compressor, a water cooling conduit in thermal exchange with said evaporator, and a thermostat arranged in thermal exchange relationship to the inlet of said conduit and the outlet of said evaporator for controlling the operation of said compressor, fan means for flowing air in thermal exchange relationship with said condenser, and safety means for preventing pressures in said system low enough to cause freezing of the water, said safety means including thermostatic means for stopping said fan means in response to a reduction in the ambient air temperatures below approximately 60° F., and a valve for controlling the flow of water through said conduit.

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